No of Pages : 3 Course Code : 12P305

Roll No:

(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, MAY - 2014

BE / BE(SW) PRODUCTION ENGINEERING Semester: 3/4

12P305 FLUID MECHANICS AND MACHINERY

Time: 3 Hours Maximum Marks: 100

INSTRUCTIONS:

- Group I, Group II and Group III questions should be answered in the Main Answer Book.
- Ignore the box titled as "Answers for Group III" in the Main Answer Book.
- Answer ALL questions from GROUP I.
- Answer any FOUR questions from GROUP II.
- Answer any ONE question from GROUP III.
- Moody's Chart, Fluid properties and Minor loss coefficient tables may be permitted.
- Graph Sheet is to be provided.
- 8. State the assumptions wherever necessary while answering Group II and III

Based on the data given below determine if blood is a Newtonian or non-Newtonian fluid.
 Give the background for the answer.

T (N / mm²)	0.04	0.06	0.12	0.18	0.30	0.52	1.12	2.10
du / dy (s 1)	2.25	4.5	11.25	22.5	45.	90	225	450

- Bring out the physical interpretation of each of the terms in the Navier Stokes equation.
- With an example each, illustrate the use of a) fixed control volume b) moving control volume c) deforming control volume.
- The x and y components of a 2-D velocity field is given by u = 1 + y; v = 1. Determine the
 equation of the streamline that passes through the origin.
- The y component of a velocity field in a steady incompressible flow field in the xy plane is given by v = Axy(y²-x²), A is a constant. Determine the x component.
- 6. What is hydrodynamic entry length in pipes?
- Write the significance of blockage ratio in wind tunnel experiments.
- "A dimpled golf ball has less drag and more lift than a smooth one". Justify this statement.
- 9. How can a spinning cylinder generate lift during flight? What is the name of this effect?
- Give the physical meaning of the shape factor in a boundary layer region.

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> GROUP - II Marks: $4 \times 12.5 = 50$

11. The drag characteristics for a newly designed automobile having a maximum characteristic length of 6 m are to be determined through a model study. The characteristics at both low speed (approximately 30 km / hr) and high speed (145 km / hr) are of interest. For a series of projected model tests, an unpressurized wind tunnel that will accommodate a model with a maximum characteristic length of 1 m is to be used. Determine the range of air velocities that would be required for the wind tunnel if Reynolds number similarity is desired. Are the velocities suitable? Explain.

- Blood (assume μ = 2.15 E-3 Ns / m², S = 1.0) flows through an artery in the neck of a giraffe from its heart to its head at a rate of 7 E-6 m3/s. Assume the length of the artery is 3 m and the diameter is 0.5 cm. If the pressure at the beginning of the artery (outlet of the heart) is 21 cm of Hg, determine the pressure at the end of the artery when the head is a) 2.4 m above the heart b) 1.8 m below the heart. Assume steady flow. How much of this pressure difference is due to elevation effects, and how much is due to frictional effects? It is observed that giraffes often keep their front legs very wide apart as shown in figure 1 while drinking water from a pond. Is this behavior of giraffes associated with the above problem? Justify the answer.
- Find the convective acceleration at the middle of a horizontal pipe, which converges uniformly from 0.4 m to 0.2 m diameter over 2 m length. The rate of flow is 20 lit /s. If the rate of flow changes uniformly from 20 lit /s to 40 lit /s in 30 seconds, find the total acceleration at the middle of the pipe at 15th second.
- 14. A Francis turbine with an overall efficiency of 75% is required to produce 150 kW at the shaft. It is working under a head of 7.62 m. The wheel runs at 150 rpm and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine (a) guide blade angle (b) vane angle at inlet (c) diameter of the wheel at the inlet (d) width of the wheel at the inlet. Take peripheral velocity = $0.26(2gH)^{1/2}$ and V_{tt} = 0.96(2gH) 43.
- 15. Aflow is described by a velocity field $\vec{y} + a \vec{y} + 1$ btj, where $\vec{a} = 1$ s¹ and $\vec{b} = 0.5$ m/s². At t = 2 s, what are the coordinates of the particle that passed through the point (1, 2). At t = 0? and At t = 3 s, what are the coordinates of the particle that passed through the PSG TECH PSG TECH point (1, 2) at t = 2 s? Plot the path line through the point (1, 2) and compare with the streamlines through the same point at the instants t = 0, 1 and 2 seconds.

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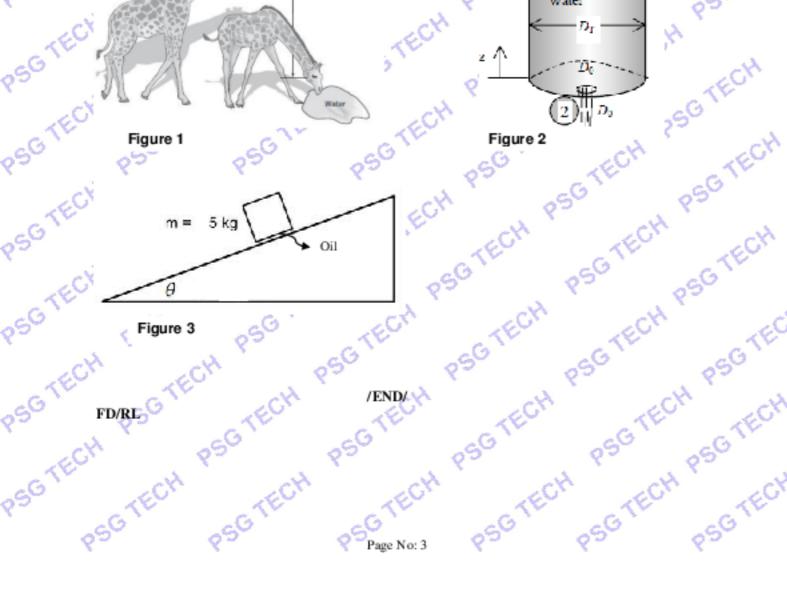
GROUP - III $Marks : 1 \times 20 = 20$

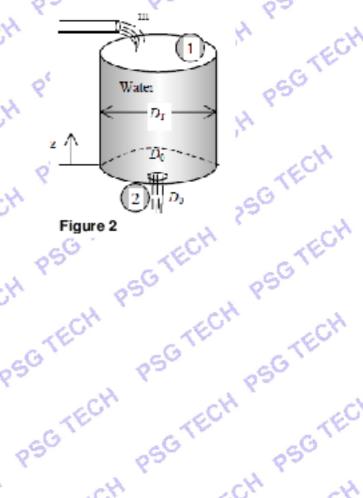
mass flow rate of min. An orifice at the bottom with diameter Do (shown in figure 2) allows water to escape. The orifice has a rounded entrance, so the first negligible. If the tank is initial. Derive the Reynolds Transport theorem. Water enters a tank of diameter D_T steadily at a

17. A block 0.1 m square, with 5 kg mass, slides down a smooth 30° inclined plane, on a film of SAE 30 oil at 20° C (µ = 0.4 N s / m²) that is 0.20 mm thick as shown in the block is released from rest. doring block is released from rest, derive an expression for the speed of the block as a function of time. Plot the curve for V(t). Find the speed after 0.1 s. If the mass is to of 0.3 m/s at this time. find the curve H PSG TECH



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